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Association Between Screen Exposure and Migraine Headache Among Medical Students of Umm Al-Qura University, Makkah, Saudi Arabia: A Cross-sectional Study

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Abstract **Background:** Recently, the use of digital screens and technology has become widespread, especially among medical students, which may have significant implications for their health and well-being. Migraine headaches are a common neurological disorder that can have a substantial impact on an individual's quality of life. The present study aims to explore the association between screen exposure and migraine headaches among medical students at Umm Al-Qura University (UQU) in Makkah, Saudi Arabia. **Methods:** This cross-sectional study was conducted among 312 medical students in UQU. A self-administered electronic questionnaire was used to gather data. We identified students with migraines using a self-administered migraine screen questionnaire (MS-Q) tool. Screen time exposure was recorded in a standardized questionnaire. **Results:** More than half of students (51.0%) reported experiencing frequent or severe headache attacks in the last 12 months. 92.5% reported using electronic devices (computer, iPad, or mobile) for their studies. Most participants were female, constituting 95.5% of the sample. Regarding age, 31.3% were 21 years old. Concerning academic year, most were in their 4th year, accounting for 41.8% of the sample, and 50.7% of respondents had a positive family history of migraines. **Conclusion:** The prevalence of migraines among medical students in Makkah was relatively high, with a female predominance. The pain intensity of the migraine headaches was associated with increasing levels of screen time exposure ($p = 0.04705$). Students' awareness of migraine management should be enhanced by avoiding trigger factors, including reducing screen time. The limited generalizability of our findings to different demographics may stem from the small sample size of a single institution.

Key Words Screen Exposure, Migraine, Headache, Medical Students

INTRODUCTION

The widespread use of digital screens and technology has become integral to modern life, especially within academic settings. Medical students rely heavily on computers, smartphones, and other digital devices for their studies, research, and communication. This increased screen exposure, however, may have significant implications for their health and well-being. Migraine headaches are a common neurological disorder that can have a substantial impact on an individual's quality of life [1]. Migraine is a primary headache disorder that is characterized by unilateral pulsating pain associated with light or sound sensitivity, nausea, and vomiting. Several factors may trigger migraine attacks, such as lack of sleep, stress, strong smells, some foods-including caffeine, milk, and alcohol-and changes in the external environment such as the weather. Migraine attacks can be relieved by avoiding these triggers [3]. Hence, prevention mitigates the negative effects of migraine attacks on individuals. The relationship between migraines and screen time exposure includes several physiological

mechanisms such as circadian rhythm and sleep disruption, photophobia and blue light sensitivity, visual fatigue, cortical excitability, and postural strain [7].

Migraines are highly prevalent worldwide, negatively affecting 19% of university students and 18% of Medical students [4]. As technology becomes integrated into every aspect of people's lives, speculation about its effects on migraines has increased. Studies have suggested a potential link between screen exposure and the development or exacerbation of migraine symptoms [5,6]. However, the available data on this relationship is limited, especially in the context of Saudi Arabian medical student populations. A previous study conducted on migraine patients revealed increased pain intensity, daytime sleepiness, poor sleep quality, and quality of life with excessive mobile phone usage [7]. Another study conducted on university students revealed an association between high screen exposure and the risk of migraine [8]. Compared to other students, medical students may spend more time in front of electronic screens. This increased screen time is largely attributed to the demanding educational requirements digitally integrated nature of modern medical education. Their reliance on electronic resources is essential for managing their complex and extensive training content, supporting both theoretical learning and clinical application. Due to the growing reliance on technology for academic purposes and the lack of data correlating screen exposure and migraines among students in the Kingdom of Saudi Arabia (KSA), the present study aims to explore the association between screen exposure and migraine headaches among medical students at Umm Al-Qura University (UQU) in Makkah, Saudi Arabia.

METHODS

Study Design

This cross-sectional study was conducted between March 2023 and May 2024 among undergraduate medical students at the College of Medicine in UQU. A self-administered electronic questionnaire was used to gather data.

Sampling

The target population was UQU medical students (from second to sixth year), who provided informed consent. First-year students were excluded because they were studying their preparatory courses and had not yet begun their specialized education (medicine, dentistry).

Sample Size Calculation

The minimum sample size required for this study was calculated by OpenEpi version 3.0. The estimated number of students was 1500, and a confidence interval of 95% was chosen. Based on an anticipated frequency of 50% and a design effect of 1, the required sample size was calculated to be 306 participants. However, we ended up with 312 responses.

Data Collection

An online questionnaire was employed in the data collection process. Data were collected from participants who met our inclusion criteria using a structured self-administered online questionnaire using Google Forms to fulfill the study objectives. The questionnaire was adopted from previous validated surveys. The survey link was distributed to the participants using the social media platform WhatsApp. It included the survey's objectives, target population, and voluntary participation request. Mandatory responses were marked with a red asterisk next to them. Participants could review their answers through the back button and change them, if necessary.

Measures

Participant Characteristics

The first section of the questionnaire had nine items assessing the basic characteristics of participants, such as sex, age, grade point average, academic year, marital status, smoking status, history of chronic diseases, exercising, and family history of migraines.

Migraine Screening

The second section of the questionnaire was a self-administered migraine screen questionnaire (MS-Q) tool [9]. The MS-Q tool is a quick assessment used for migraine screening. This tool consists of five questions about the frequency of headache attacks, characteristics, and symptoms. We measured responses using yes/no and multiple-choice options. One point was given if the participant answers "yes" to any question. A migraine was suspected if the score was 4 points or more [9].

Migraine Features

The third section consists of four items related to migraine features: frequency, duration, aura, and pain severity. The following question evaluated frequency: "Approximately how often do headache attacks occur?" The options included: 1-3 attacks per week, 4-6 attacks per week, 2 attacks per month, 1 attack per month, and 1 attack per year. Headache duration was assessed by the following question: "Approximately how long does a headache attack last (in the last 3 months)?" The options included: more than 24 hours, between 1 to 24 hours, and less than 1 hour [9,10]. The pain intensity was measured using the VRS-6 scale, where 0 denotes no pain and 5 the most severe pain [11].

Screen Time Exposure

A self-report was used to assess the average time that the participants spent on screen, including three devices: smartphone, iPad, and computer/tablet. From 0 (never) to 5 (more than 8 hours), the participants recorded the total time spent in front of an electronic screen. To summarize the screen time exposure, an unweighted scoring system was used. The score was divided into four categories; very low, low, high, and very high [12].

Ethical Considerations

This study was approved by the Biomedical Research Ethics Committee of UQU (Approval number: HAPO-02-K-012-2023-09-1706]. All participants were informed about the study objectives, and informed consent was received at the beginning of the survey. Students participated in the study voluntarily.

Data Analysis

The statistical analysis for this study was conducted using R software, version 4.3.1. Descriptive statistics were used to summarize the characteristics of the study participants and the prevalence of migraine headaches. Categorical variables were presented as frequencies and percentages. Fisher's exact test was used to study the association between demographic characteristics and migraine headache characteristics with screen time exposure levels due to the expected cell counts of less than five. A significant p-value of <0.05 was used for all the statistical tests.

RESULTS

Students' Responses to the Migraine Screen Questionnaire

In the current study, we received 314 responses from students. However, we excluded three records of students who disagreed to participate. Therefore, records of 311 medical students were included. More than half of students reported experiencing frequent or severe headache attacks in the last 12 months (51.0%), and 41.4% indicated that their headaches typically lasted more than 4 hours. Additionally, 34.3% reported suffering from nausea during headaches, while 66.9% indicated that light or noise bothered them when experiencing a headache. Moreover, 58.3% reported that headaches limited either their physical or intellectual activities.

Characteristics of Migraine Headaches

Thirty-nine percent reported no frequent headaches, whereas 38.59% reported non-migraine headaches. Importantly, the prevalence of migraine headache was 21.54%.

Among the migraine sufferers (n = 67), the majority were female, constituting 95.5% of the sample. Regarding age distribution, 31.3% were 21 years old and 28.4% were 22 years or older. In terms of academic performance, 85.1% had a grade point average of 3.5 or higher. Concerning the academic year, the highest frequency was observed in the 4th year, accounting for 41.8% of the sample. Moreover, the vast majority was single (94.0%). Additionally, 88.1% reported no chronic diseases. Finally, 95.5% were non-smokers, and 62.7% reported not exercising regularly (Table 1).

The distribution of migraine characteristics showed that 50.7% of respondents had a positive family history of migraines, while 49.3% did not. Regarding the frequency of headache attacks, the majority experienced 1-3 attacks per week (32.8%) or 2 attacks per month (28.4%). In terms of duration, 74.6% reported headache attacks lasting between 1 to 24 hours. Additionally, 49.3% reported having an aura associated with their headaches (Table 2). Regarding pain intensity, the majority experienced either moderate (Level 2, 31.3%) or severe (Level 3, 34.3%) pain during migraine episodes (Figure 1).

Table 1: Demographic characteristics of students with migraine (n = 67)

Characteristic	Missing	N (%)
Sex	0 (0%)	
Male		3 (4.5%)
Female		64 (95.5%)
Age (Year)	0 (0%)	
19		10 (14.9%)
20		17 (25.4%)
21		21 (31.3%)
22 or more		19 (28.4%)
Grade point average (GPA)	0 (0%)	
<2.5		0 (0.0%)
2.5 to 3.5		3 (4.5%)
3.0 to 3.5		7 (10.4%)
3.5 or more		57 (85.1%)
Academic year	0 (0%)	
2nd year		15 (22.4%)
3rd year		13 (19.4%)
4th year		28 (41.8%)
5th year		7 (10.4%)
6th year		4 (6.0%)
Marital status	0 (0%)	
Single		63 (94.0%)
Married		4 (6.0%)
Chronic diseases	0 (0%)	
No		59 (88.1%)
Yes		8 (11.9%)
Smoker	0 (0%)	
No		64 (95.5%)
Yes		3 (4.5%)
Exercise regularly	0 (0%)	
No		42 (62.7%)
Yes		25 (37.3%)

Table 2: Characteristics of migraine headache among migraine sufferers (n = 67)

Characteristic	N (%)
A positive family history of migraine	
No	33 (49.3%)
Yes	34 (50.7%)
Frequency of headache attacks	
Irregular (approximately 1 episode per year)	5 (7.5%)
One attack per month	5 (7.5%)
Two attacks per month	19 (28.4%)
1-3 attacks per week	22 (32.8%)
4-6 attacks per week	16 (23.9%)
Duration of headache attacks in the last 3 Months	
Less than 1 hour	7 (10.4%)
Between 1 to 24 hours	50 (74.6%)
More than 24 hours	10 (14.9%)
Have an aura associated with headache	
No	34 (50.7%)
Yes	33 (49.3%)

Characteristics of Screen use Among Students with Migraines

Table 3 presents characteristics of screen use among students with migraines (n = 67). The vast majority, comprising 92.5%, reported using electronic devices (computer, iPad, or

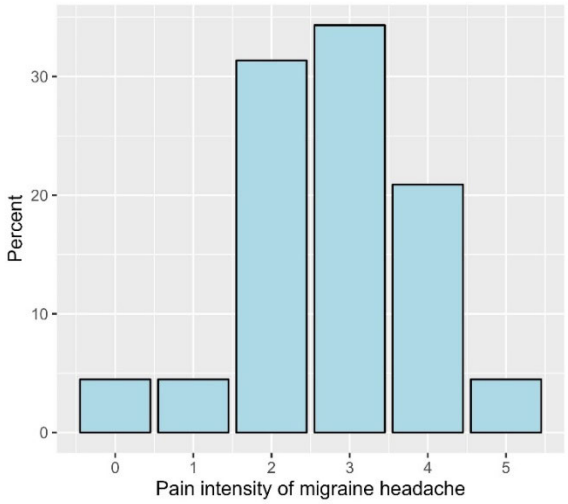

Figure 1: The proportions of pain intensity categories among students with migraine headache
Pain intensity levels were graded as 0 (No pain), 1 (Mild pain), 2 (Moderate pain), 3 (Severe pain), 4 (Very severe pain) or 5 (Most severe pain imaginable)

Table 3: Characteristics of screen use among students with migraine (n = 67)

Characteristic	Missing	N (%)
Using electronic devices (computer, iPad, or mobile) in studies		
No	0 (0%)	5 (7.5%)
Yes		62 (92.5%)
Most common electronic devices used for studying		
Tablet	0 (0%)	5 (7.5%)
ipad		55 (82.1%)
Smartphone		11 (16.4%)
Total time you spend in front of an electronic screen		
Never	0 (0%)	1 (1.5%)
Less than 30 min		3 (4.5%)
30 minutes to 2 hrs		3 (4.5%)
2 to 4 hrs		4 (6.0%)
4 to 8 hrs		17 (25.4%)
>8 hrs		39 (58.2%)
Using the screen of the electronic device before sleep		
No	0 (0%)	6 (9.0%)
Yes		61 (91.0%)
Using electronic devices in the dark room		
No	0 (0%)	10 (14.9%)
Yes		57 (85.1%)

mobile) for studies. The most common electronic device used for studying was the iPad, accounting for 82.1% of the sample. In terms of total screen time, 58.2% reported spending more than 8 hours in front of electronic screens daily. Additionally, 91.0% reported using electronic devices before sleep, and 85.1% reported using them in dark rooms (Table 3).

Factors Associated with Screen Time Exposure

Table 4 presents demographic characteristics stratified by the time of exposure to screens among the surveyed students. A significant association was observed between grade point average and screen time exposure (p = 0.026), as well as between the presence of chronic diseases and screen time exposure (p = 0.007). Specifically, students with higher screen time exposure tended to have higher GPAs, with 81.0% of those with high exposure and 89.7% of those with very high exposure having a GPA of 3.5 or more compared to 33.3% among students with low exposure. Conversely, a higher proportion of students without chronic diseases was found among those with very low (50.0%) and low (33.3%) screen time exposure compared to those with higher exposure levels (19.0% and 2.6% for high and very high exposure levels, respectively).

A significant association was observed between the pain intensity of a migraine headache and the time of exposure to screens (p = 0.04705). However, no significant associations were observed between the other characteristics of a migraine headache and the time of exposure to screens. The p-values for the other characteristics were above the

Table 4: Demographic characteristics by the time of exposure to screen

Characteristic	Screen time exposure				p-value
	Very low (N = 4)	Low (N = 3)	High (N = 21)	Very high (N = 39)	
Sex					
Male	0 (0.0%)	0 (0.0%)	1 (4.8%)	2 (5.1%)	>0.999
Female	4 (100.0%)	3 (100.0%)	20 (95.2%)	37 (94.9%)	
Age (Year)					
19	1 (25.0%)	0 (0.0%)	1 (4.8%)	8 (20.5%)	0.697
20	1 (25.0%)	1 (33.3%)	5 (23.8%)	10 (25.6%)	
21	1 (25.0%)	1 (33.3%)	6 (28.6%)	13 (33.3%)	
22 or more	1 (25.0%)	1 (33.3%)	9 (42.9%)	8 (20.5%)	
Grade point average					
<2.5	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.026
2.5 to 3.5	0 (0.0%)	2 (66.7%)	1 (4.8%)	0 (0.0%)	
3.0 to 3.5	0 (0.0%)	0 (0.0%)	3 (14.3%)	4 (10.3%)	
3.5 or more	4 (100.0%)	1 (33.3%)	17 (81.0%)	35 (89.7%)	
Academic year					
2nd year	0 (0.0%)	0 (0.0%)	4 (19.0%)	11 (28.2%)	0.170
3rd year	1 (25.0%)	0 (0.0%)	3 (14.3%)	9 (23.1%)	
4th year	3 (75.0%)	2 (66.7%)	7 (33.3%)	16 (41.0%)	
5th year	0 (0.0%)	1 (33.3%)	3 (14.3%)	3 (7.7%)	
6th year	0 (0.0%)	0 (0.0%)	4 (19.0%)	0 (0.0%)	
Marital status					
Single	4 (100.0%)	3 (100.0%)	19 (90.5%)	37 (94.9%)	0.750
Married	0 (0.0%)	0 (0.0%)	2 (9.5%)	2 (5.1%)	
Chronic diseases					
No	2 (50.0%)	2 (66.7%)	17 (81.0%)	38 (97.4%)	0.007
Yes	2 (50.0%)	1 (33.3%)	4 (19.0%)	1 (2.6%)	
Smoker					
No	4 (100.0%)	3 (100.0%)	20 (95.2%)	37 (94.9%)	>0.999
Yes	0 (0.0%)	0 (0.0%)	1 (4.8%)	2 (5.1%)	
Exercise regularly					
No	1 (25.0%)	2 (66.7%)	15 (71.4%)	24 (61.5%)	0.368
Yes	3 (75.0%)	1 (33.3%)	6 (28.6%)	15 (38.5%)	

Fisher's exact test

threshold of significance (p>0.05), indicating that the frequency of migraine attacks, duration, presence of aura, and family history of migraines were not significantly associated with varying levels of screen time exposure among migraine sufferers (Table 5).

DISCUSSION

Particularly among young people, the use of electronic media with a screen interface, such as televisions, computers, tablets, and smartphones, is highly widespread [1]. These devices have seamlessly integrated into our personal, social, and professional lives [2]. There is a significant frequency of headaches, especially migraines, among college students [3,4], particularly in the medical field [5,7], who report particularly high levels of screen time exposure. To our knowledge, no previous study has evaluated the association between screen exposure and migraine headaches in Makkah, Saudi Arabia. Thus, the current study aimed to assess this association among medical students at UQU in Makkah.

In this study, more than half of the students (51.0%) reported experiencing frequent or severe headache attacks in the last 12 months. This prevalence was lower than that reported in Jazan, which was 83% among medical students for a study covering one year [2]. The prevalence of migraines in our population was 21.54%, which was higher than those reported in Egyptian medical students in two similar studies 17.27% [13], and 17.9% [10], respectively.

Lower prevalence figures were recorded by several other researches; 14.1% in Nigeria [14], 13.1% in Southeast Nigeria [15], 12.6% in Turkey [16], 12.2% in Oman [17], and 7.14% in Southeast Iran [18].

The prevalence of migraine headaches was higher in females than males (95.5% vs. 4.5%). These results matched with a Saudi study conducted by Alqassim *et al.* [6]. Furthermore, we agreed with Ragab *et al.* [13] that females reported a greater prevalence of migraines than males (76.86% versus 23.13%, respectively). The International Classification of Headache Disorders (ICHD) refers to this as an estrogen-withdrawal headache [19]. The higher prevalence of migraine in females may attributed to hormonal fluctuations. A migraine is caused by the activation and transmission of pain signals to the trigeminal nerve by estrogen, which also promotes the production and release of nitric oxide and calcitonin gene-related peptide. Additionally, by creating an imbalance in magnesium and calcium levels, estrogen may contribute to migraine and neuronal excitation [20].

According to the present study's findings, 50.7% of students who suffer from migraines have a positive family

Table 5: Characteristics of migraine and headache by the time of exposure to screen

Characteristic	Overall (N = 67)	Screen time exposure				p-value
		Very low (N = 4)	Low (N = 3)	High (N = 21)	Very high (N = 39)	
A positive family history of migraine						
No	33 (49.3%)	4 (100.0%)	1 (33.3%)	7 (33.3%)	21 (53.8%)	0.061
Yes	34 (50.7%)	0 (0.0%)	2 (66.7%)	14 (66.7%)	18 (46.2%)	
Frequency of headache attacks						
Irregular (approximately 1 episode per year)	5 (7.5%)	0 (0.0%)	0 (0.0%)	2 (9.5%)	3 (7.7%)	0.567
One attack per month	5 (7.5%)	0 (0.0%)	0 (0.0%)	4 (19.0%)	1 (2.6%)	
Two attacks per month	19 (28.4%)	1 (25.0%)	1 (33.3%)	4 (19.0%)	13 (33.3%)	
1-3 attacks per week	22 (32.8%)	2 (50.0%)	0 (0.0%)	7 (33.3%)	13 (33.3%)	
4-6 attacks per week	16 (23.9%)	1 (25.0%)	2 (66.7%)	4 (19.0%)	9 (23.1%)	
Duration of headache attacks in the last 3 Months						
Less than 1 hour	7 (10.4%)	0 (0.0%)	0 (0.0%)	2 (9.5%)	5 (12.8%)	0.625
Between 1 to 24 hours	50 (74.6%)	2 (50.0%)	3 (100.0%)	16 (76.2%)	29 (74.4%)	
More than 24 hours	10 (14.9%)	2 (50.0%)	0 (0.0%)	3 (14.3%)	5 (12.8%)	
Have an aura associated with headache						
No	34 (50.7%)	1 (25.0%)	3 (100.0%)	9 (42.9%)	21 (53.8%)	0.263
Yes	33 (49.3%)	3 (75.0%)	0 (0.0%)	12 (57.1%)	18 (46.2%)	
Pain intensity of migraine headaches						
0 (No pain)	3 (4.5%)	2 (50.0%)	0 (0.0%)	1 (6.2%)	0 (0.0%)	0.04705
1 (Mild pain)	3 (4.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (6.8%)	
2 (Moderate pain)	21 (31.3%)	0 (0.0%)	1 (33.3%)	6 (37.5%)	14 (31.8%)	
3 (Severe pain)	23 (34.3%)	0 (0.0%)	1 (33.3%)	4 (25.0%)	18 (40.9%)	
4 (Very severe pain)	14 (20.9%)	1 (25.0%)	1 (33.3%)	5 (31.2%)	7 (15.9%)	
5 (Most severe pain imaginable)	3 (4.5%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	2 (4.5%)	

Fisher's exact test

history of the condition. Ghorbani *et al.* [8] and Ragab *et al.* [13] reported a lower percentage (20.6% and 34.9%, respectively), while Balaban *et al.* [16] reported a higher percentage (72%). This may be explained by the findings of the Bigal *et al.* [22] research, which showed that financial stress in patients without significant hereditary factors may contribute to migraines, owing to personal or family economic status.

The current study revealed that 32.8% of migraine students experienced 1-3 attacks per month, 74.6% of whom experienced a duration lasting from 1 to 24 hours. These results are comparable with Ragab *et al.* [13], who reported that 38.5% of migraineur students experienced 1-4 attacks per month, 55.5% of whom experienced a duration last from 4 to 72 hours.

This study found that about half (50.7%) of migraine students experienced migraines without an aura, which was little lower than those in Ragab *et al.* [13] (68.8%), and another previous study, which reported that 63.9% of participants had migraines without an aura [23].

Our findings confirm the results of previous studies showing associations between excessive electronic device usage and migraines, especially among medical populations [6,8,24] since 92.5% of our students who suffered migraine used electronic devices.

Most of the exposure time was related to working on an iPad. More than half (58.2%) spent more than 8 hours in front of an electronic screen. 91.0% reported using electronic devices before sleep, and 85.1% reported using them in dark rooms. In addition, in the current study there was a significant association between the pain intensity of a migraine headache and the time of exposure to screens. The strong correlation between increased screen exposure duration and headache reports among migraine participants may be explained by these findings. The potential relationship between screen time and migraine pathophysiology has been reported in previous studies. One study reported that migraine attacks may be directly caused by the brightness or frequency of screen light and migraine cascade threshold may be lowered by increasing screen time exposure [25]. Another study suggested that constantly focusing the eye on the screen for several hours per day can stress the ocular muscles and cause eye fatigue, which leads to headache attacks [26].

CONCLUSIONS

In conclusion, the prevalence of migraines among medical students in Makkah was relatively high with a female predominance. The prevalence of migraines among medical students using electronic devices was very high. The pain intensity of migraine headaches was associated with increasing levels of screen time exposure. Students' awareness of migraine management should be enhanced by reducing screen time.

The limited generalizability of our findings to different demographics may possibly stem from the small sample size from a single institution.

Limitations

To confirm and expand on these findings, studies with long-term research using objective metrics, more representative samples, and evaluations of multidimensional variables are required. Moreover, further studies are needed to

understand the mechanisms behind screen exposure and its negative impacts on migraine, and effective management for reducing screen time exposure must be identified.

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